

Claims

1. A gain-controlled amplifier, characterized by comprising:

5 a plurality of differential amplifier stages connected to each other by cascade connection, each of said differential amplifier stages performing gain control by a gain control voltage;

10 a plurality of common feedback circuits provided correspondingly to each of said plurality of differential amplifier stages, each of said common feedback circuits keeping a center value of an output DC of each of said differential amplifier stages to be constant; and

15 a DC feedback circuit provided between an output side of a last stage of said plurality of differential amplifier stages and an input side of a first stage of said differential amplifier stages, said DC feedback circuit changing a DC feedback quantity according to said gain control voltage.

20 2. The gain-controlled amplifier according to claim 1, characterized in that each of said plurality of differential amplifier stages comprises:

a differential amplifier in which a gain is changed according to said gain control voltage;

25 a first current source in which a current value is changed according to said gain control voltage; and

30 a Gilbert cell circuit provided between a load side of said differential amplifier and a power source, said Gilbert cell including a second current source constituting a current mirror with said first current source.

3. The gain-controlled amplifier according to claim 1, characterized in that each of said plurality of common feedback circuits comprises:

5 a first difference circuits for outputting a difference of each positive phase output of said plurality of differential amplifier stages to a predetermined reference voltage;

10 a second difference circuits for outputting a difference of each opposite phase output of said plurality of differential amplifier stages to said predetermined reference voltage; and an adder for adding each difference output of said first difference circuit and said second difference circuit;

15 wherein a current value of a current source constituting each stage of said plurality of difference amplifier stages is controlled by an added output of said adder.

4. The gain-controlled amplifier according to claim 1, characterized in that said DC feedback circuit comprises:

20 a detector circuit for detecting an output voltage at a last stage of said plurality of differential amplifier stages; and

25 a variable gain amplifier for amplifying an output of said detector circuit by a gain in accordance with said gain control voltage;

wherein an output of said variable gain amplifier is added to an input of a first stage of said plurality of difference amplifier.

5. A receiver circuit, characterized by comprising a 30 gain-controlled amplifier for adjusting an amplitude of a

signal obtained by performing a frequency conversion of a received signal, wherein said gain-controlled amplifier has:

5 a plurality of differential amplifier stages connected to each other by cascade connection, each of said differential amplifier stages performing gain control by a gain control voltage;

10 a plurality of common feedback circuits provided correspondingly to each of said plurality of differential amplifier stages, each of said common feedback circuits keeping a center value of an output DC of each of the differential amplifier stages to be constant; and

15 a DC feedback circuit provided between an output side of a last stage of said plurality of differential amplifier stages and an input side of a first stage of said differential amplifier stages, the DC feedback circuit changing a DC feedback quantity according to said gain control voltage.

6. A radio communication device, characterized by comprising:

20 an antenna;

frequency converting means for performing a frequency conversion of a high frequency signal received by said antenna; and

25 a gain-controlled amplifier for adjusting an amplitude of a signal obtained by performing the frequency conversion of a received signal;

wherein said gain-controlled amplifier has:

30 a plurality of differential amplifier stages connected to each other by cascade connection, each of said differential amplifier stages performing gain control by a gain control

voltage;

a plurality of common feedback circuits provided correspondingly to each of said plurality of differential amplifier stages, each of said common feedback circuits keeping
5 a center value of an output DC of each of said differential amplifier stages to be constant; and

a DC feedback circuit provided between an output side of a last stage of said plurality of differential amplifier stages and an input side of a first stage of said differential
10 amplifier stages, said DC feedback circuit changing a DC feedback quantity according to said gain control voltage.